CLAIMS

1. A memory cell, comprising:

    a host material layer, said host material layer exhibiting zero field splitting and being configured to store data as an energy-absorbing state and a lesser-energy-absorbing state; and

    a first electrode and a second electrode, each being electrically coupled to said host material layer.

2. The memory cell of claim 1, wherein said host material layer incorporates metal ions, said metal ions exhibiting said zero field splitting.

3. The memory cell of claim 1, wherein said lesser-energy-absorbing state is a non-energy-absorbing state.

4. The memory cell of claim 1, wherein said host material layer is organic.

5. The memory cell of claim 1, wherein said host material layer is a polymer.

6. The memory cell of claim 1, wherein said host material layer is inorganic.

7. The memory cell of claim 1, wherein said host material layer is a chalcogenide glass.

8. The memory cell of claim 1, wherein said host material layer is germanium selenide.

9. The memory cell of claim 8, wherein said germanium selenide is $Ge_{40}Se_{60}$.

10. The memory cell of claim 2, wherein said metal ions comprise ions of a metal selected from the group consisting of Co, Cr, Fe, Mn, Ti, Cu, Zn, V, Cd, and Ni.

11. The memory cell of claim 2, wherein said metal ions comprise Mn^{+2}.

12. The memory cell of claim 1, wherein said host material layer is $Ge_{40}Se_{60}$ that incorporates about 3 wt. % Mn^{+2} as metal ions.

13. The memory cell of claim 2, wherein said host material layer and said metal ions are configured to absorb a detectable amount of energy corresponding to a separation in electron spin level energy of said metal ions at zero field.

14. The memory cell of claim 2, wherein said host material layer and said metal ions are configured to absorb about 0.03 cm^{-1} to about 3.3 cm^{-1} when said memory device is programmed to said energy-absorbing state.

15. The memory cell of claim 2, wherein said hose material layer and said metal ions are configured to absorb about 0.33 cm^{-1} when said memory device is programmed to said energy-absorbing state.

16. The memory cell of claim 1, wherein one of said first and second electrodes is manganese and the other is tungsten.

17. The memory cell of claim 1, wherein said device is configured to be programmed to said energy-absorbing state by a light pulse.

18. The memory cell of claim 1, wherein said device is configured to be programmed to said energy-absorbing state by an electrical pulse.

19. A zero-field splitting memory device, comprising:

a first electrode;

a germanium selenide layer in contact with said first electrode, said germanium selenide layer having a stoichiometry of Ge_xSe_{100-x};

metal ions incorporated into said germanium selenide layer, wherein said germanium selenide and said metal ions are configured to absorb a detectable amount of energy when said memory device is programmed to an energy-absorbing state; and

a second electrode in contact with said germanium selenide layer.

20. The zero-field splitting memory device of claim 19, wherein said first electrode, said germanium selenide layer, and said second electrode are vertically stacked.

21. The zero-field splitting memory device of claim 19, wherein said germanium selenide is $Ge_{40}Se_{60}$ and said metal ions comprise Mn^{+2}.

22. The zero-field splitting memory device of claim 21, wherein said $Ge_{40}Se_{60}$ incorporates about 3 wt. % Mn^{+2}.

23. The zero-field splitting memory device of claim 22, wherein said detectable amount of energy is about 0.03 cm^{-1} to about 3.3 cm^{-1}.

24. The zero-field splitting memory device of claim 19, wherein said germanium selenide layer is about 100 Å to about 2,000 Å in thickness.

25. The zero-field splitting memory device of claim 19, wherein said metal ions comprise ions of a metal selected from the group consisting of Co, Cr, Fe, Mn, Ti, Cu, Zn, Ni, V, Cd, and combinations thereof.

26. The zero-field splitting memory device of claim 19, wherein said device comprises a plurality of memory cells each comprising a respective said first electrode, said germanium selenide layer, and said second electrode.

27. A multiple-bit memory device, comprising:

a host material incorporating a plurality of different metal ion types, said each of said different metal ion types exhibiting zero field splitting, said host material and said different metal ion types being configured to store data as a plurality of energy-absorbing states and a non-energy-absorbing state; and

a first electrode and a second electrode, each being electrically coupled to said host material.

28. The multiple-bit memory device of claim 27, wherein said first electrode, said host material, and said second electrode are stacked vertically.

29. The multiple-bit memory device of claim 27, wherein said host material is organic.

30. The multiple-bit memory device of claim 27, wherein said host material is a polymer.

31. The multiple-bit memory device of claim 27, wherein said host material is inorganic.

32. The multiple-bit memory device of claim 27, wherein said host material is a chalcogenide glass.

33. The multiple-bit memory device of claim 27, wherein said host material is germanium selenide.

34. The multiple-bit memory device of claim 33, wherein said germanium selenide is $Ge_{40}Se_{60}$.

35. The multiple-bit memory device of claim 27, wherein said plurality of different metal ion types comprise ions of at least two metal species selected from the group consisting of Co, Cr, Fe, Mn, Ti, Cu, Zn, V, Cd, and Ni.

36. The multiple-bit memory device of claim 27, wherein said plurality of different metal ion types comprise Mn^{+3}.

37. The multiple-bit memory device of claim 27, wherein said host material is $Ge_{40}Se_{60}$ incorporating Mn^{+2} and Cu^{+2} as said plurality of different metal ion types.

38. The multiple-bit memory device of claim 27, wherein said host material and said plurality of different metal ion types are configured to absorb a detectable amount of energy corresponding to a separation in energy of the electron spin levels of each of said plurality of different metal ion types at zero field.

39. The multiple-bit memory device of claim 27, wherein said host material and said metal ions are configured to absorb about 0.03 cm^{-1} to about 3.3 cm^{-1} when said memory device is programmed to one of said plurality of energy-absorbing states and a different amount of energy at a different one of said plurality of energy-absorbing states.

40. The multiple-bit memory device of claim 27, wherein said device is configured to be programmed to said plurality of energy-absorbing states by light pulses.

41. The multiple-bit memory device of claim 27, wherein said device is configured to be programmed to said plurality of energy-absorbing states by electrical pulses.

42. A processor-based device, comprising:

a processor; and

a memory cell, comprising:

a host material incorporating metal ions, said metal ions exhibiting zero field splitting and said host material being configured to

store data as an energy-absorbing state and a non-energy-absorbing state; and

a first electrode and a second electrode, each being electrically coupled to said host material.

43. The processor-based device of claim 42, wherein said metal ions comprise Mn^{+2}.

44. The processor-based device of claim 41, wherein said host material is $Ge_{40}Se_{60}$ incorporating about 3 wt. % Mn^{+2} as said metal ions.

45. The processor-based device of claim 42, wherein said host material and said metal ions are configured to absorb a detectable amount of energy corresponding to a separation in the electron spin level energy of said metal ions at zero field.

46. The processor-based device of claim 42, wherein said host material and one of said plurality of different metal ion types are configured to absorb about 0.03 cm^{-1} to about 3.3 cm^{-1} when said memory device is programmed to said energy-absorbing state.

47. A method of operating a memory device, comprising:

providing a memory device comprising a host material which incorporates metal ions exhibiting zero field splitting;

programming said memory device to an energy-absorbing state corresponding to a separation of spin states of said metal ions at zero magnetic field; and

reading said memory device by sensing the absorption or transmission of a read energy pulse through said host material.

48. The method of claim 47, wherein said host material comprises an organic ligand.

49. The method of claim 47, wherein said host material comprises a polymer.

50. The method of claim 47, wherein said host material comprises an inorganic ligand.

51. The method of claim 47, wherein said host material comprises a chalcogenide glass.

52. The method of claim 47, wherein said host material comprises germanium selenide.

53. The method of claim 47, wherein said host material comprises $Ge_{40}Se_{60}$ glass.

54. The method of claim 47, wherein said metal ions comprise ions of a metal selected from the group consisting of Co, Cr, Fe, Mn, Ti, Cu, Zn, Ni, V, Cd, and combinations thereof.

55. The method of claim 47, wherein said metal ions comprise Mn^{+2}.

56. The method of claim 47, wherein said programming said memory device comprises applying a write voltage to said host material.

57. The method of claim 47, wherein said programming said memory device comprises applying a light pulse to said host material.

58. The method of claim 47, wherein said reading said memory device comprises applying energy to said host material without changing the programming of said memory device.

59. The method of claim 47, wherein said reading said memory device comprises applying energy to said host material in the microwave frequency range.

60. The method of claim 47, wherein said reading said memory device comprises applying an energy pulse to said host material of at least about 0.03 cm^{-1}.

61. The method of claim 47, further comprising programming said memory device to a non-energy-absorbing state after reading.

62. A method of operating a multiple-bit memory cell, comprising:

providing a memory cell comprising a host material which incorporates a plurality of metal ion species, each said species exhibiting zero field splitting;

programming said memory cell to at least one of a plurality of energy-absorbing states, each said energy-absorbing state corresponding to a separation of spin states of a respective one of said plurality of metal ion species at zero magnetic field; and

reading said memory device by sensing the absorption or transmission of one of a plurality of read energy pulses through said host material, said one read energy pulse corresponding to said respective one metal ion species.

63. The method of claim 62, wherein said host material comprises an organic ligand.

64. The method of claim 62, wherein said host material comprises a polymer.

65. The method of claim 62, wherein said host material comprises an inorganic ligand.

66. The method of claim 62, wherein said host material comprises a chalcogenide glass.

67. The method of claim 62, wherein said host material comprises germanium selenide.

68. The method of claim 62, wherein said host material comprises $Ge_{40}Se_{60}$ glass.

69. The method of claim 62, wherein said plurality of metal ion species comprises ions of at least two metals selected from the group consisting of Co, Cr, Fe, Mn, Ti, Cu, Zn, V, Cd, and Ni.

70. The method of claim 62, wherein said respective one metal ion species is Mn^{+2}.

71. The method of claim 62, wherein a second respective metal ion species is Cu^{+2}.

72. The method of claim 62, wherein said programming said memory cell comprises applying a write voltage to said host material.

73. The method of claim 62, wherein said programming said memory cell comprises applying a light pulse to said host material.

74. The method of claim 62, wherein said reading said memory cell comprises applying energy to said host material without changing the programming of said memory device.

75. The method of claim 62, wherein said reading said memory cell comprises applying energy to said host material in the microwave frequency range.

76. The method of claim 62, wherein said reading said memory cell comprises applying an energy pulse to said host material of at least about 0.03 cm^{-1} for said respective one metal ion species.

77. The method of claim 62, further comprising programming said memory cell to a non-energy-absorbing state after reading.